

Approved by: \_\_\_\_\_  
Supervisor, Refuges North                      Date

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Parker River National Wildlife Refuge was established in 1942 primarily to provide feeding, resting and nesting habitat for migratory birds. The Refuge consists of 4,662 acres of diverse upland and wetland habitats including sandy beach, dune, Maritime shrubs and forests, salt marsh, man-made impoundments, and grassland habitats. These Refuge habitats support varied and abundant populations of resident and migratory wildlife species including more than 300 species of birds and additional species of mammals, reptiles, amphibians, insects and plants. The Refuge also supports nesting piping plovers, a federally listed threatened species.

Parker River also administers the Thacher Island National Wildlife Refuge, located off the coast of Rockport. Thacher Island historically supported a large tern colony, and has been managed in cooperation with the Town of Rockport and the Thacher Island Association since the late 1990s.

In 2006, we completed a Habitat Management Plan for the two Refuges, which will guide the management of the wildlife and habitats on the Refuges for the next 15 years. The goals, objectives, and strategies from the HMP are incorporated into this Annual Habitat Work Plan and will guide management for 2008.

## **A. Piping Plover and Least Tern Management**

### *Habitat Objective*

Work cooperatively with State (Sandy Point State Reservation) and local towns (Newburyport and Newbury) to protect from disturbance and degradation nine miles of nesting, staging, and foraging habitat for piping plovers and least terns. Through seasonal closures, predator management, and public education, maintain a minimum productivity of 1.5 chicks per pair over a five-year period for piping plovers and a nesting least tern colony of 50-100 pairs.

### *2007 Management Prescription*

Starting April 1, the Refuge closed the entire length of the Refuge beach to public access except for the 0.10 mile section north of Lot 1. To further minimize public disturbance, volunteer “plover wardens” are recruited to sit at the north and south end of the beach closure. Plover wardens prevent potential trespassers, educate the public about plovers and the role the Refuge plays in protecting this species, and report any trespass to Refuge staff. Sections of the beach are opened to public use as the chicks fledge. The southern portion of the Refuge beach (Lot 6 and 7) was opened on July 13<sup>th</sup>. The entire beach was re-opened on September 1<sup>st</sup>.

At Sandy Point, the beach area in between the two trails from the lower lot was symbolically fenced on April 1, and the symbolic fence was expanded throughout the summer to accommodate nesting plovers as the beach built up.

Monitoring of plover nesting activity began in late March with the arrival of plovers on Plum Island. Starting April 23<sup>rd</sup>, surveys were conducted 2-3 times a week by walking the beach or using an All Terrain Vehicle (ATV). As the plovers establish pair bonds,

begin courtship and initiate territory defense, nest searches were conducted daily to locate the nest. Monitoring is conducted 2-3 times a week during incubating period, and 3-4 times a week until the chicks fledge (sustained flight of 100+ feet or 25 days of age). For failed nests, we survey the immediate area intensely to monitor re-nesting attempts and to locate the new nest.

Electric fences were used on the Refuge beach to protect a least tern colony and at Sandy Point to protect 4 to 6 pairs of nesting plovers and additional nesting terns. Due to adult predation associated with exclosures in past years, we only used exclosures to protect two nests on the Town beach and one nest at Sandy Point.

We also conducted weekly shorebird surveys (May 16-Sept 24) on the Refuge beach to monitor use during fall migrations. Surveys were conducted at various times during the day and at a range of tides by 2 staff using ATVs.

### *Habitat Response*

A Nor'easter on Patriot's Day drastically altered the available nesting habitat on the Refuge and at Sandy Point. On the Refuge, the storm and subsequent high tides reduced the amount of available nesting habitat. In many places, the high tide line came up to the base of the primary dunes. At Sandy Point State Reservation, the storm set back the beach grass/ beach pea dune in the primary nesting area. The nesting area was initially restricted by high tides, however, the beach built up over the summer, creating extensive nesting habitat for plovers and terns.

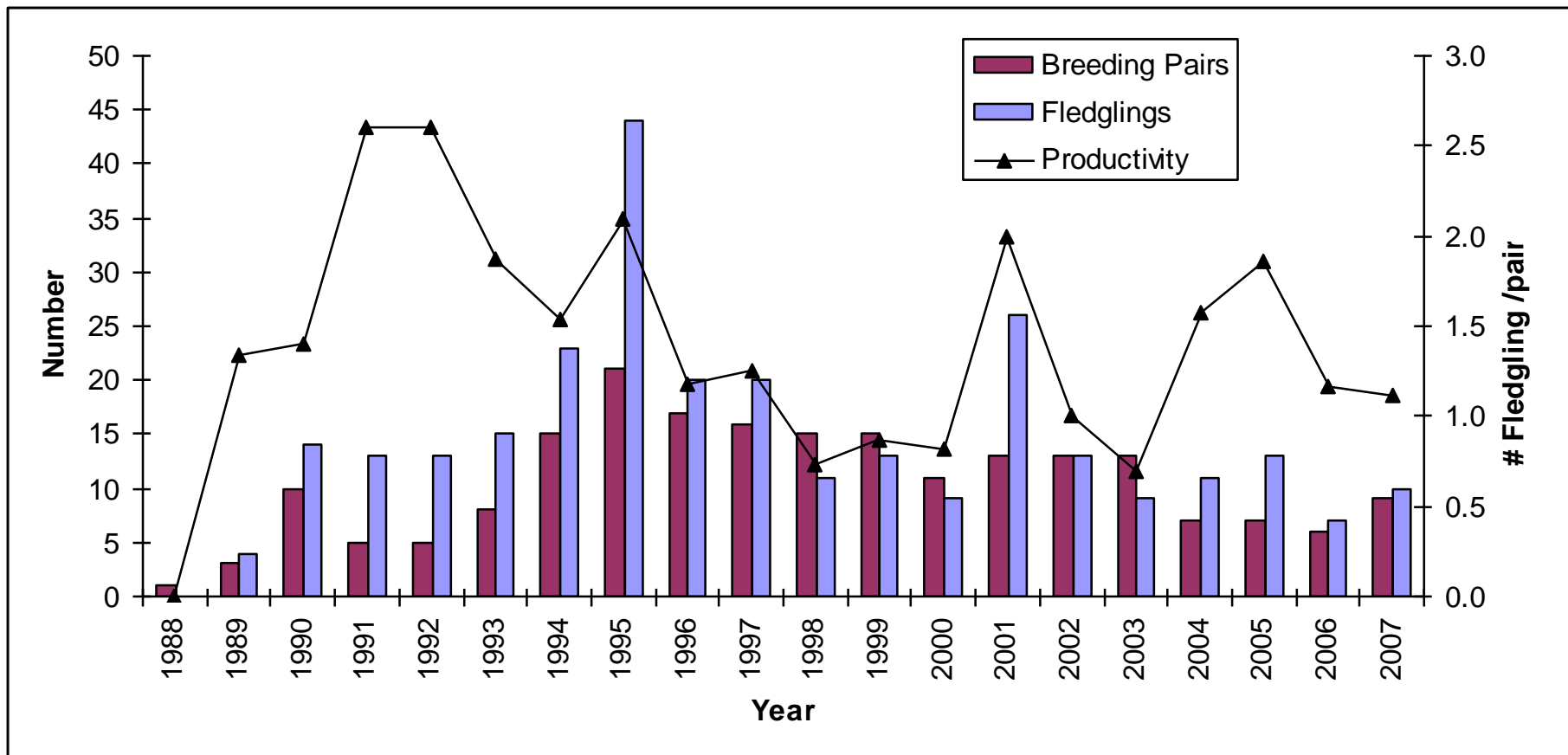
### *Response of Resources of Concern*

#### Piping Plovers

During the 2007 nesting season, 17 pairs of piping plover and 44 pairs of least terns nested on Plum Island. The plovers produced 24 nests, 70 eggs, 30 chicks, and 17 fledglings. Nine pairs (53%) successfully fledged young in 2008. Hatching success was 43%; fledgling success was 57% and overall productivity was 1.0 fledglings per nesting pair (Figure 1). The 5-year average productivity for Plum Island is 1.3 fledglings per pair.

The Patriot's Day storm caused the plovers to nest higher on the beach and closer together than in previous years. On the Refuge, most plovers nested between Lot 2 and Lot 3. At Sandy Point, the majority nested in between the two trails from the lower parking lot, enabling staff to protect the nests with the electric fence.

Predation was the major cause of nest failure during the 2007 season, accounting for 50% of nest failures. Second was high tide washing over nests, accounting for 28% of the nest failures. Least tern population was up from the previous year's count of 30 pairs, but productivity (0.4) for the 2007 season, although better than previous year, is still low.



**Figure 1.** Breeding pairs of piping plovers and fledgling success at Parker River National Wildlife Refuge from 1985 to 2007. Productivity is calculated as number of fledged young per breeding pair. Plover productivity at Sandy Point and Town beaches are not included in the above figure.

### Least Terns

Two separate tern colonies established within 0.5 mi of each other on the Refuge beach. Colony A was at mile 0.5 to 0.79 and Colony B was at mile 1.08 to 1.25. During the tern census on June 18<sup>th</sup>, we counted 10 pairs at Colony A and 21 pairs at Colony B. We installed an electric fence around Colony A, but not in Colony B because many of the nests were right at or slightly above the high tide line. Colony B was washed over and later predated by a coyote, causing the terns to abandon and join the electrically fenced Colony A. A female fox got into the electric fence, and did not do much damage to the tern colony as the majority of nests had already hatched. We estimated 13 least tern chicks successfully fledged out of 31 pairs, for a productivity of 0.4 chicks per pair.

A small tern colony attempted to nest at Sandy Point State Reservation. An electric fence had been installed around four nesting plover pairs earlier. The terns initially nested outside the fence, and moved inside the fence as they lost nests to predation. However, due to battery failures and constant high tides requiring removal of part of the electric fence, predators continue to decimate the colony. The terns finally abandoned the colony around July 16<sup>th</sup>. We estimated 14 breeding pairs in this colony, although it was difficult to get an accurate count due to high nest predation.

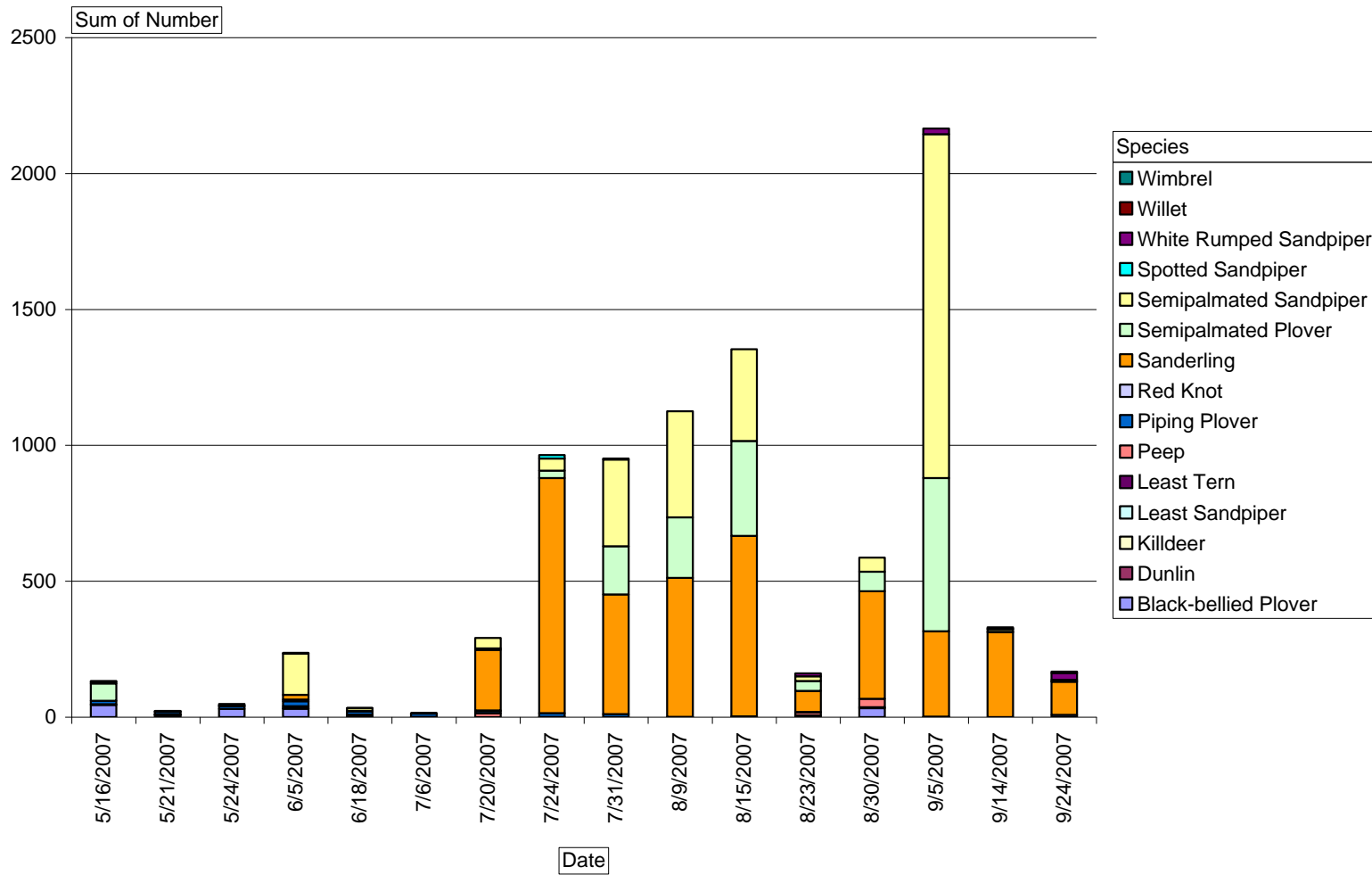
For a detailed report on the plover and tern management program, see the 2007 Annual Plover and Tern Report.

### Shorebirds

Fall shorebird migration started in late July on the Refuge beach, and peaked on September 5, when we counted 2,165 birds (see Figure 2). The most abundant species was sanderling, followed by semipalmated sandpiper and semipalmated plovers. Concentrations of shorebirds were found throughout the Refuge beach, with roosting sites concentrated between Milemarkers 0.5 and 2.0.

### *Proposal Year: Management Strategy Prescriptions*

- Close the Refuge beach beginning April 1, including beach access lots 2, 3, 6, and 7. Parking lots will remain closed while those sections of the beach still support nesting activity for plovers and terns.
- Working with DCR, Federal and State Endangered Species Programs, and towns of Newbury and Newburyport, further minimize disturbance of plovers nesting on town and State beaches by increasing signage and enforcement.
- Contract with USDA to remove potential predators, including raccoons, skunks, red fox, grey fox and coyote prior to plover nesting season. Closely monitor predation on plovers and terns and target problem animals during the nesting season.
- Continue to use electric fence around tern nesting colony on Refuge beach and plover and tern nests at Sandy Point.
- Closely monitor nesting plover pairs, and adjust management (e.g. installing symbolic fencing, predator exclosure) as needed.
- On a case by case basis, evaluate the pros and cons of nest exclosures and install circular exclosures if risk of adult predation is low.



**Figure 2.** Summary of week shorebird surveys conducted on Refuge beach in summer/fall of 2007.

## **B. Maritime Shrubland and Forests**

### *Habitat Objective*

Manage 333 acres of maritime shrubland and forest to provide nesting and migratory stopover habitat for landbirds of conservation concern including eastern towhee, brown thrasher, prairie warbler, and to benefit the New England cottontail. Specific management objectives are:

1. Annually, maintain a minimum of 100 acres of maritime shrub and forest habitat with medium to high stem density (>10,000 stems/ha) to provide nesting and feeding habitat for eastern towhee, brown thrasher, and prairie warbler.
2. By 2021, increase native maritime shrub and forest communities (dominated by native fruit-bearing shrubs and trees, including shadbush, black cherry, arrowwood, beach plum, bayberry, and elderberry and comprising less than 5% invasive plants) to 50-100 acres to benefit fruit-eating migratory landbirds.

### *2007 Management Prescription*

#### Monitoring and Surveys

Massachusetts Audubon has been running a spring and fall migratory banding station in the shrub habitat on the Refuge since 1998. The spring banding season began on April 3 and closed on June 6, with a total of 42 banding days. The fall banding season began on August 30 and closed November 2<sup>nd</sup>, with a total of 59 banding days.

#### Herbivore Management

The annual deer hunt was held on December 5<sup>rd</sup>. Thirty five hunters participated in the hunt and harvested one fawn.

### *Habitat Response*

#### Invasive Plant Management

In 2005 and 2006, we treated stands of multi-flora rose along the road. In 2007, we found and treated only 3 plants of multiflora rose, indicating that early control efforts have been effective. We will continue to monitor this species and treat as needed.

### *Response of Resources of Concern*

#### Monitoring and Surveys

In 2007, the Massachusetts Audubon banding station banded 81 species totaling 3,309 birds with a banding effort of 8,578 net hours. The most common species captured were gray catbird, yellow-rumped warbler, common yellow throat, ruby-crowned kinglet and white-throated sparrow. Recapture data indicate that Parker River NWR is an important stopover area for migrating song birds, particularly during the fall migration. This is especially true for young birds (hatched the same year), as they make up 81 to 94 percent of all birds captured during the fall migration. Recapture data also demonstrate that birds



exhibit significant weight gain during their stay, indicating that the Refuge is providing good stopover habitat.

**Table 1.** Number and species of birds banded at the Massachusetts Audubon banding station at Parker River Refuge from 2001 to 2006.

Year	Spring			Fall			Total	
	# sp	# bird	catch per effort	#sp	# bird	catch per effort <sup>1</sup>	# sp	# bird
2007	62	1832	56.32	70	1486	27.90	81	3309
2006	45	452	20.62	62	1396	33.63	70	1848
2005	48	930	42.31	66	1758	58.1	72	2359
2004	69	1361	51.00	66	2092	38.88	87	3453
2003	62	698	36 days*	45	881	39 days*	76	1579
2002	69	1473	63.8	57	1176	41.5	82	2649
2001	62	893	44.25	62	1484	59.67	76	2377

\*net hours were not available in 2003 to calculate catch per effort

### *Proposal Year: Management Strategy Prescription*

- Continue to partner with Massachusetts Audubon Society to monitor landbird use of maritime shrub and forest habitat during spring and fall migration through the banding program.
- Continue the annual one-day deer hunt program to maintain a sustainable deer population. Discontinue the Refuge check station as insufficient numbers of deer are harvested to obtain Refuge-specific biological data.
- Monitor beaver activity for excessive tree felling and girdling. If negative impact on shrub habitat is determined to be excessive, remove problem beaver through trapping.
- Initiate restoration of the south 10-acre of the North Pool field to Maritime shrubland. In 2008, let field revert to shrub, and treat invasive shrub species during growing season.
- Control invasive plants through cutting, girdling, pulling, herbicide application targeting at eradication of certain early detection species (e.g. black locust, rusty willow, autumn olive, multiflora rose), and restoring areas of low invasion.

## **C. Exemplary Plant Communities**

### *Habitat Objective*

Maintain the native plant diversity, physiographic characteristics, and natural functions of the refuge's exemplary plant communities -- interdunal swale, sandplain grassland, and pitch pine dune woodland.

<sup>1</sup> Catch per effort is calculated as the total number of birds caught per 100 net hours. For 2003, catch per effort was not calculated as survey effort was recorded in days instead of net hours

*2007 Management Prescription*

No management was conducted in pitch pine, interdunal swale, or sandplain grassland due to lack of funding.

*Habitat Response*

N/A

*Response of the Resources of Concern*

N/A

*Proposal Year: Management Strategy Prescription*

- Conduct frog-call surveys three times in the spring, timing surveys to major rain events or significant warming periods.
- Remove 5-10 acres black pine forest to pitch pine dune woodlands.
  - Selectively cut black pines using chainsaw or heavy equipment (e.g. Geoboy), leaving select mature black pines to provide shelter for seedlings.
  - Plant pitch pine seedlings and saplings (up to 5 feet), spaced 15 to 20 feet apart during spring (April to June). Plants should be obtained from a local source if possible; check commercially available plants to ensure that parent stock are obtained from coastal Massachusetts, New England, or New Jersey. Water seedlings and saplings as needed for the first two months.
  - Monitor restoration sites for invasive plants and treat with backpack sprayer as needed.
- Treat Phragmites in Lot 2 swale through cut-stem and drop method, and monitor Galerucella beetle populations in swales; augmenting population as needed.

**D. Salt Marsh***Habitat Objective*

Annually, manage 2,660 acres of salt marsh, including a mix of high and low salt marsh vegetation comprised of less than 5% overall cover of invasive plants, and pool and panne habitat consistent with local reference sites, to ensure that the quality and natural function of the marsh are sustained and provide breeding habitat for Nelson's and saltmarsh sharp-tailed sparrows, and seaside sparrow, wintering areas for American black duck, and foraging areas for marsh and wading birds and migrating shorebirds.

*2007 Management Prescription*Mercury Bioaccumulation Study

Since 2004, Parker River has been participating in a multi-refuge, long-term salt marsh sparrow mercury bioaccumulation study. Because early investigations found Parker River Refuge to have the highest blood mercury among all salt marsh sharp-tailed sparrows sampled in New England, we have been investigating potential impacts to reproductive success and potential point sources of mercury in the Plum Island Sound watershed since 2006. We also collected foraging and nest characteristic data for the sparrows, and collected prey invertebrates to investigate potential contaminant pathway.

### Monitoring and Surveys

Surveys conducted in the salt marsh include the salt marsh sparrow survey and the colonial nesting bird survey (coordinated by the State). The salt marsh sparrow survey was conducted three times during 2007: June 22, July 23, and August 14. The colonial nesting bird survey was conducted on June 12<sup>th</sup>.

### Invasive Plant Control

The Refuge has been coordinating several community-based invasive plant control programs in an effort to eradicate these species from the Refuge and surrounding areas. In 2007, we:

- Implemented follow-up treatments on knotweed stands along the Plum Island Turnpike and at Sandy Point.
- Expanded the community perennial pepperweed control project to include the Great Marsh salt marsh community from Essex to Salisbury.
- Partnered with Eight Towns and the Bay and Ducks Unlimited to initiate a Great Marsh *Phragmites* control project adjacent to the Refuge.

### *Habitat Response*

#### Invasive Plant Control

*Japanese knotweed*: Four knotweed sites totaling 3 acres received follow-up treatment with 5% Rodeo solution applied with backpack sprayer. This achieved a 95% control at 2 refuge sites and 50-75% control at 2 privately owned sites along the Plum Island Turnpike. At all sites native plants were growing in areas which previously had 100% knotweed cover.

*Perennial pepperweed*: Eighty one volunteers contributed 201 hours between May and August to control pepperweed both on refuge lands and in the Great Marsh region. A total of 8.5 acres were treated by hand-pulling or application of 0.03% Escort solution. On the refuge, 1.1 acres were hand-pulled and 2.2 acres were treated with herbicide for 3.3 acres total treated. Four previously treated sites on the refuge did not have pepperweed when monitored in 2007.

*Phragmites*: In September, *Phragmites* stands within 10m of the refuge road were spot treated with 1.5% Rodeo. *Phragmites* on the perimeter of Cross Farm was also treated with this herbicide solution.

In late September, we began a *Phragmites* control project along Little Pine Creek in partnership with Ducks Unlimited and Eight Towns and the Bay. We used the “cut and drop” technique on 27 low density stands applying 25% Rodeo solution directly into cut *Phragmites* stems. 1.5% Rodeo solution was applied with backpack sprayers to 57 medium and high density stands. Pre-selected pilot sites will be monitored in 2008 to evaluate the treatments’ efficacy.

*Response of Resources of Concern*Mercury Bioaccumulation Study

Refuge staff and volunteers conducted more than 200 hours of nest searches and found 53 salt marsh sharp-tailed sparrow nests. The majority of nests (78%) were found in *Spatina patens* marshes. We observed that as the breeding season progressed, the sparrows built nests higher off the marsh, on average, 2 cm higher each successive nesting cycle.

Salt marsh sparrows returned to Parker River in late May and nested during three tidal cycles the summer. As tidal cycles greatly affect nesting success, we divided the nests into cohort groups (nests that initiated incubation at roughly the same time) in the Table below.

**Table 2.** Summary of Saltmarsh Sharp-tailed Sparrow nesting at Parker River National Wildlife Refuge, 2007.

	Cycle 1	Cycle 2	Cycle 3	Cycle 4
Approx. Nest Initiation Date	5-31	6-20	7-19	8-14
Invertebrate Collection Date	--	6-21	7-24	8-14
Nests Found	14	23	15	1
Nests with Eggs	8 (23 eggs)	14 (46 eggs)	9 (27eggs)	1 (3 eggs)
Nests Hatched	0	6 (20 chicks)	6 (20 chicks)	1 (3 chicks)
Nests Fledged	0	5 (15 chicks)	5 (16 chicks)	1 (3 chicks)
Hatching Success (%)	0	43%	74%	100%
Fledgling Success (%)	0	75%	80%	100%
Overall Success (%)	0	33%	59%	100%
Percent Predated	12.5	21.4	10	0
Percent Flooded	87.5	14.3	0	0
Percent Abandoned	0.00	28.57	0	0
Mean Nest Height in cm (# nest)	8.9 (n=10)	11.0 (n=20)	13.2 (n=12)	20 (n=1)
Hg samples collected:				
Nests with unviable eggs	6	7	2	0
Nests with females	0	8	6	0

Nesting success at Parker River in 2007 was significantly better compared to that of 2006, and is comparable to nesting success at Rachel Carson in 2006. Although preliminary, the two years of productivity data suggest that adult blood mercury levels may be influencing sparrow reproductive success. Blood mercury levels were much higher in 2006 ( $2.26 \pm 0.8$  ppm) compared to 2007 ( $1.38 \pm 0.4$  ppm) (See Figure 3). Specifically, viability of sparrow eggs and fledgling success appear to be affected by mercury levels (Table 3).

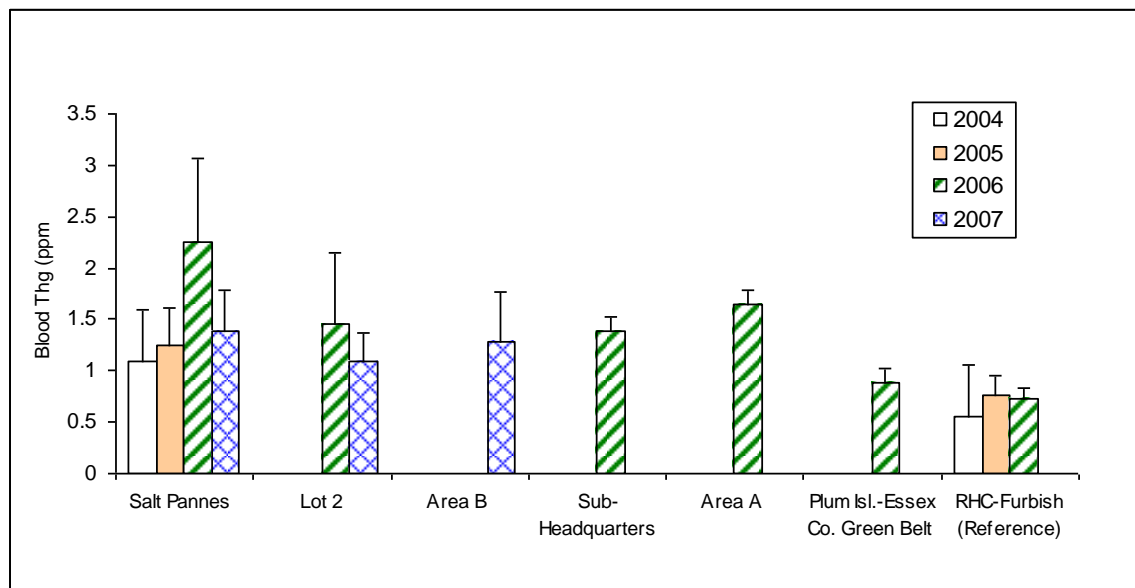
**Table 3.** Mayfield probability of reproductive success for salt marsh sharp-tailed sparrows at Parker River and Rachel Carson NWR.

	Prob of nest surviving incubation <sup>¥</sup>	Prob of nest surviving to fledging <sup>¥</sup>	Hatching rate	Probability of nesting success <sup>¥</sup>
Parker River 2006	0.4164-0.4941	0.7486-0.8107	0.5322	0.17-0.21
Parker River 2007	0.3910-0.4735	0.8995-0.9370	0.7592	0.27-0.34
Rachel Carson 2006	0.7134-0.7791	0.4619-0.5730	0.8478	0.28-0.38

\*Note: Due to lack of staff, insufficient nesting data was collected at Rachel Carson in 2007 to calculate Mayfield productivity.

<sup>¥</sup>Probability of survival is represented using 95% confidence intervals.

We capture 97 sparrows throughout the marsh in 2006 and 2007 in an effort to locate mercury hotspots within the Refuge salt marsh. The highest mercury levels were at the salt pannes, where we had been monitoring productivity for the past 2 years. The site with the lowest mercury level was found on the Essex County Greenbelt property directly north of the Refuge. In 2007, Biodiversity Research Institute sampled three sparrows at the Bill Forward Wildlife Management Area, located approximately four miles from the mouth of the Parker River, and found the highest level of blood mercury (1.53 ppm). From the distribution of mercury at sites sampled so far, it appears that there may be potential mercury source in the Parker River watershed. The site closest to the Merrimack River (the Greenbelt property) has the lowest in mercury, but we need to sample more sites adjacent to the Merrimack to rule out a potential mercury source.

**Figure 3.** Blood mercury found in salt marsh sharp-tailed sparrow at various sites in and around Parker River NWR from 2004 to 2007.

Preliminary Hg data on invertebrates collected in June suggest that none of the invertebrate have abnormally high mercury levels (100-300 ppb), although spiders did have higher mercury loads compared to other groups (spiders=74 ppb, hoppers=4.7 ppb,

caterpillars=0.66 ppb). Foraging observation found the sparrow to be feeding on spiders, Diptera larvae, and amphipods. Results of the remaining samples will help guide invertebrate sample next year to further investigate trophic pathway.

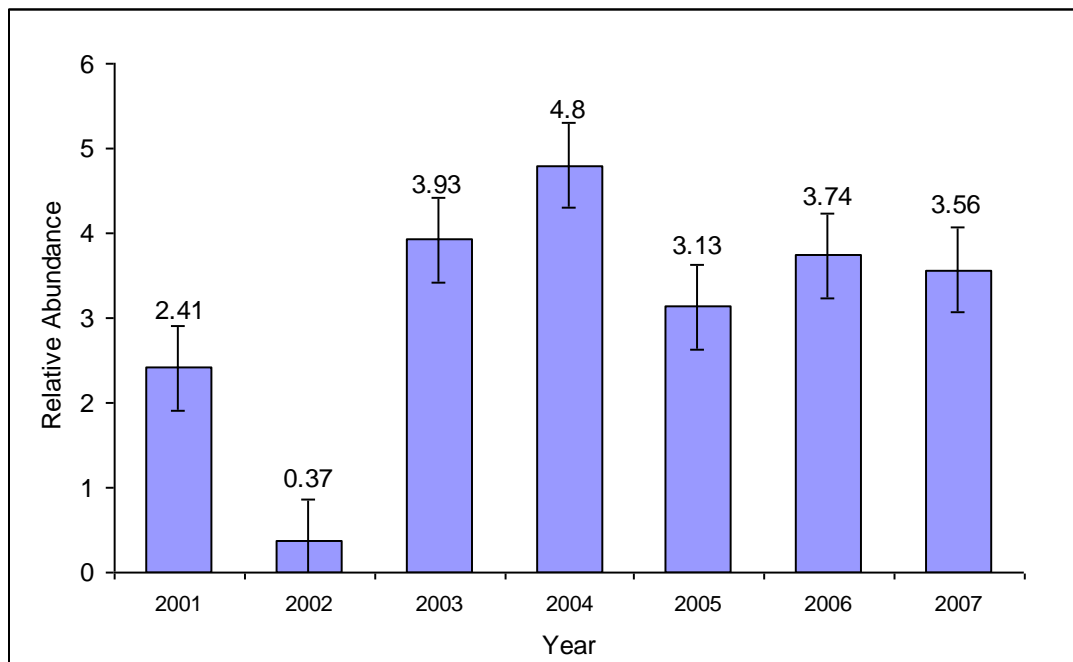
### Monitoring and Surveys

The breeding tern population in the Plum Island Sound increased compared to recent years, particularly along the Plum Island River. Substantial colonies appear to be establishing on Pork Island and just south of Plum Island Turnpike.

**Table 4.** Common tern breeding pairs observed nesting in Plum Island salt marshes during the State count window (mid June) from 2002 to 2007.

Year	Woodbridge	Plum Island Sound Marshes	Total
<b>2007</b>	58	104	<b>162</b>
<b>2006</b>	67	50	<b>117</b>
<b>2005</b>	80	21	<b>101</b>
<b>2004</b>	96	26	<b>122</b>
<b>2003</b>	75	24	<b>99</b>
<b>2002</b>	80	24	<b>104</b>

For a fifth year in a row, the number of sharp-tailed saltmarsh sparrows detected during the annual breeding surveys continues to be high (Figure 4).



**Figure 4.** Relative abundance of sharp-tailed saltmarsh sparrow in call-back surveys, calculated as total number of individuals divided by total survey points. Three surveys were conducted for 2001, 2002, and 2007 breeding season. From 2003 to 2006, only one survey was conducted per year.

*Proposed Year: Management Strategy Prescriptions*

- Conduct three salt marsh sharp-tailed sparrow surveys, corresponding to the start of each breeding cycle.
- Continue to participate in the ongoing mercury bio-accumulation study in salt marsh sparrow, and seek additional funding to expand research to investigate the geographic and biological (species) scope of mercury and other contaminants (e.g. PCBs, organophosphates).
  - Continue to monitor the reproductive success of salt marsh sparrows and potential impacts from Hg.
  - Using color bands and radio-transmitters, monitor behavior and local movement of nesting female sparrows.
  - Continue to investigate trophic pathway of mercury levels in the salt marsh system, targeting spiders, Diptera larvae, and amphipods.
  - Conduct more in-depth foraging behavior observations to determine sparrow prey selection and foraging habitat.
  - Work with partners to investigate point sources for Hg along the Parker River.
- Continue to control invasive plant species (*Phragmites*, perennial pepperweed, Japanese knotweed) in the salt marsh through cutting, hand pulling, stem injection, and herbicide application (cut and drop or spot treatment).
  - Continue off-Refuge Japanese knotweed control and treat all stands on Plum Island and along the turnpike.
  - Expand perennial pepperweed control through the Great Marsh and work with partners to initiate control in New Hampshire.
  - Continue to treat emergent *Phragmites* in the salt marsh, and experiment with various treatment techniques.
- Continue to annually monitor common tern nesting colonies in Plum Island Sound as part of the State's annual colonial nesting bird surveys. As funding allows, increase monitoring of colonies to assess nesting success.

**E Grassland and Early Successional Habitats***Habitat Objective*

Manage 80 to 130 acres of grassland habitat with minimum size of 20 acres at a height of 8 to 12 inches during the summer to provide nesting habitat for grassland nesting birds, such as bobolink and northern harrier, and migration habitat for Lepidoptera, whimbrels, and other species.

*2007 Management Prescription*Grassland and Early Successional Habitat Management

The Refuge has maintained 130 acres of grasslands through annual mowing to provide breeding and migratory habitat for grassland dependent species such as the Northern Bobolink, Savannah Sparrow, Meadowlarks and several species of raptors including Short-eared owls and Northern Harriers. The open field habitat include: the North Pool Field, south portion of the Bill Forward Field, Cross-Farm Hill, Stage Island Field, and Nelson's Island.

In 2007, we mowed the open fields from August 8 to September 5<sup>th</sup>. Due to shortage of staff resources, only half of Cross Farm Hill was mowed. The north portion of Bill Forward Field is maintained as early successional shrub habitat, and is mowed on a 3-5 year cycle. No management was conducted in this shrub habitat in 2007.

#### Artificial Nesting Structures

The Refuge maintains artificial nesting structures for two species, purple martin and ospreys, that have largely lost their natural breeding habitat. Purple martin colonies are located at three sites throughout the Refuge: at the old Refuge HQ located on the north end of Plum Island, the new HQ site, and the visitor contact station near lot #1. Osprey platforms are located at three sites throughout the Refuge: the end of the Pines Trail road in the salt marsh, on the south side of Cross Farm hill and at Nelson's Island.

#### Invasive Plant Management

On August 2, we spot treated small stands of spotted knapweed (totaling 2 acres) in grassland habitats throughout the Refuge with 1.5% Garlon. In mid September, we sprayed approximately 2 acres of leafy and cypress spurge in the Bill Forward shrub using 1.5% Rodeo. The treatment was timed with the second growth period of the invasive plant for maximum effectiveness. A photoplot was established to monitor long term control success.

#### *Habitat Response*

#### Invasive Plant Control

Control of spotted knapweed and multiflora rose has been found to be over 90% effective in past year, and is assessed visually. Photoplots were established to monitor control of leafy spurge.

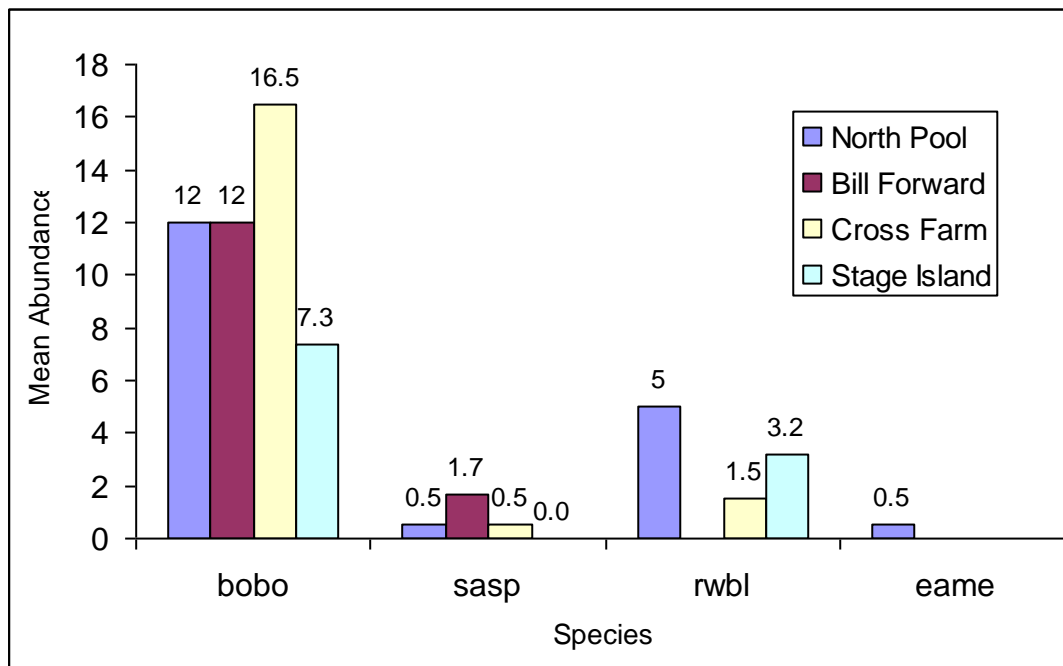
#### *Response of Resources of Concern*

#### Grassland Nesting Birds

Grassland breeding surveys were conducted on June 23, July 7, and July 14<sup>th</sup>. Abundance of grassland breeding species was similar to that found in 2005. Bobolinks were the most abundant species breeding in the fields, with Cross Farm supporting the largest population (Figure 5). Red winged black birds is the second most abundant, with the largest population in the North Pool, and low numbers of Savanna sparrows were found, with the highest population at Bill Forward Pool. Savanna sparrow abundance was lower in 2007 (0.7 per survey point) as compared to 2005 (1.9 per survey point).



One eastern meadowlark was observed in the North Pool field on July 7<sup>th</sup>. This species is an occasional breeder on the Refuge.



**Figure 5.** Grassland nesting bird abundance at North Pool field, Bill Forward Field, Cross Farm and Stage Island in 2007.

#### Artificial Nesting Structures

Volunteers monitor purple martin nest boxes for productivity once a week, and eject house sparrow nests. Although the number of nesting pairs is down in 2006 and 2007 compared to previous years, the total number of young fledged has been increasing the last four years. In the past two years, the fledgling rate has been 100%, compared to less than 50 in the prior two years. Nesting success of purple martins is largely dependent on weather as purple martins cannot feed during long periods of rain. The high fledgling rate the last two years can be attributed to good weather during the nestling stage.

**Table 5.** Productivity results from Purple Martin colonies at old HQ and Lot 1. The colonies at new HQ has never been occupied.

	2004	2005	2006	2007
nests with eggs	45	38	21	29
total # of eggs (E)	225	179	96	127
# of eggs that hatched (H)	163	101	71	82
% of eggs that hatched (H/E)	72	56	74	65
total # of young fledged (F)	61	50	71	82
% of young that fledged (F/H)	37	50	100	100
overall success rate (F/E)	27	28	74	65

#### *Proposal Year: Management Strategy Prescriptions*

- Mow grassland units after bird breeding season (July 31). Mow the Bill Forward Shrub in spring prior to start of bird breeding (May 1). Mow shrub islands harboring invasive plants, and follow up in fall with spot treatment of invasive shrubs.

- Let southern third of the North Pool Field revert to open shrub habitat. Monitor shrub regeneration and control invasive species (glossy buckthorn and morrow's honeysuckle) to ensure a native dominated vegetative community.
- Map and treat black swallowwort at Cross Farm; and continue spotted knapweed and leafy spurge control
- Install purple martin boxes at old HQ, new HQ, and Lot 1 in early April, and continue to monitor purple martin productivity using volunteers.
- Continue to conduct breeding bird surveys in grassland units.

## **F. Impoundment Management**

### *Habitat Objective*

Annually manage the three brackish impoundments (totaling 262 acres) to support spring and fall migrating shorebirds, spring and fall migrating waterfowl (American black duck), and breeding marsh and wading birds. Management prescription will change from year to year, dependent on wetland dynamics and vegetative composition, but will be directed to provide the following each year:

1. Migrating shorebirds: shallow (<10 inches water depth) to mudflat habitat with sparse (<15% cover) to no vegetation, at time of peak migration (late May and early August)/
2. Fall migrating waterfowl: shallow flooded (<12 inches) annual vegetation composed primarily of *Cyperus*, *Echinochloa*, *Polygonum*, *Bidens* and other seed producing moist soil vegetation at time of peak migration (late October to early November)
3. Manage for breeding wading birds (e.g. clapper rail, American bittern, king rail, least bitter, marsh wren, sora) and waterfowl (e.g. black duck, green-winged teal, gadwall) by maintaining water levels and controlling invasive plants.

### *2007 Management Prescriptions*

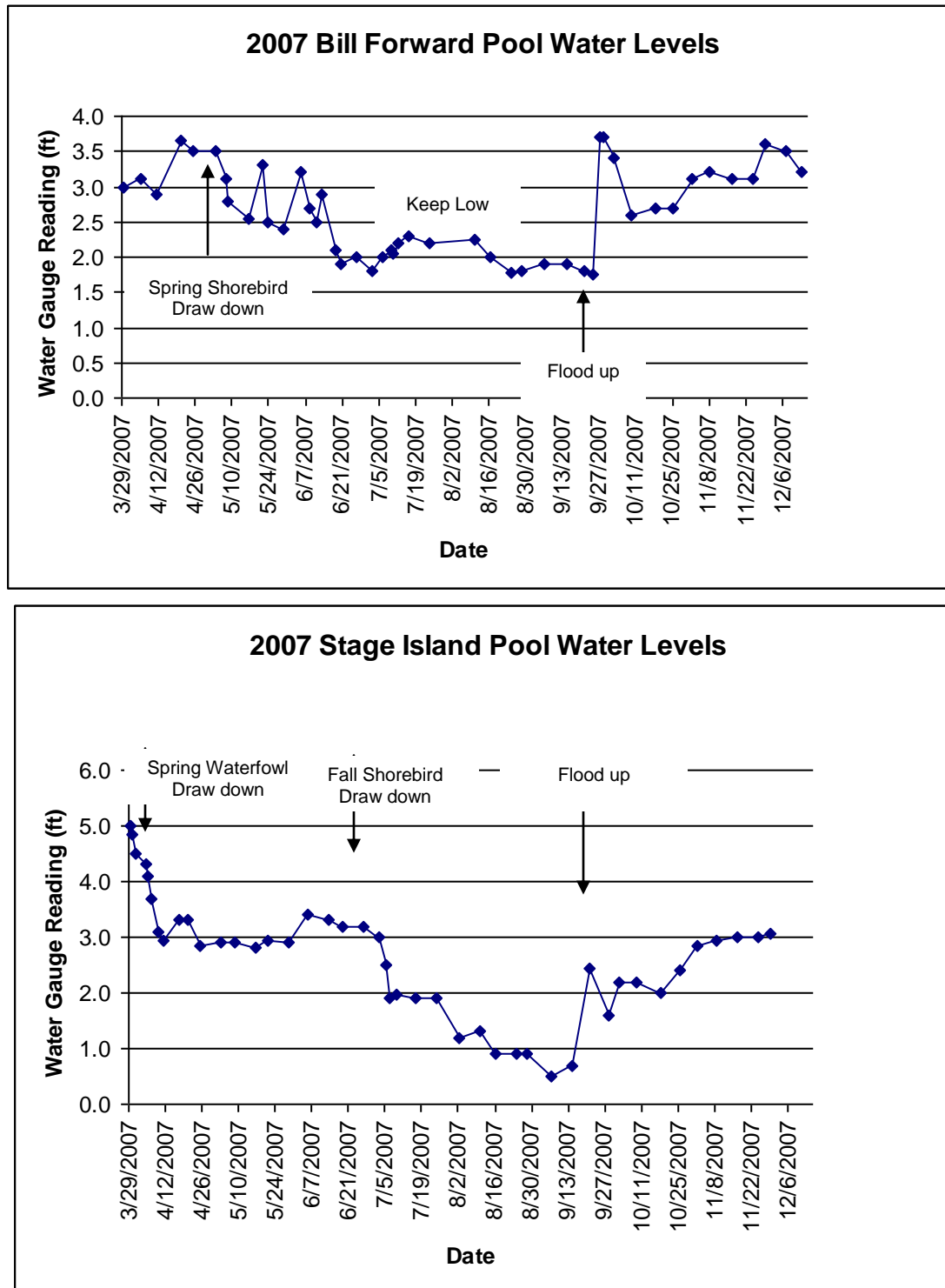
#### North Pool

No management was conducted in the North Pool for 2007. Call back surveys were conducted twice in the North Pool to monitor for breeding marsh and wading birds.

#### Regional Shorebird Impoundment Study

Bill Forward and Stage Island Pools participated in Year 3 of the R3/5 Impoundment Study. Bill Forward Pool received spring draw down for 2007. The objective was to expose the maximum mud flat and shallow water (< 10 inches) during peak spring shorebird migration (May 25). We started the draw down of the Bill Forward Pool using the new water control structure on May 7<sup>th</sup>. Due to heavy rain events in May and early June, water levels fluctuated between 2.5' and 3.5' late May to mid June, with a low water reading of 1.9 on June 20<sup>th</sup>. We re-flooded the impoundment starting mid-September. The impoundment froze on December 7 (Figure 6).

Stage Island Pool received the fall shorebird draw down for 2007. The objective was to provide waterfowl foraging during the spring migration and expose maximum mudflat



**Figure 6.** Water levels in the Bill Forward and Stage Island Impoundments through the 2007 field season.

and shallow water during peak fall shorebird migration (August 10). We started draw down in Stage Island on March 30, maintaining the water level at 3.0' for the spring waterfowl migration. For the fall shorebird migration, we started draw down on July 5, and flood up in late September. The water level was maintained between 0.9' to 2.0' for the fall shorebird migration and between 2.0' and 2.5' for the fall waterfowl migration. The impoundment froze on December 7 (Figure 6).

Habitat surveys conducted as part of the impoundment study include two vegetation cover surveys. We were not able to complete the species composition survey due to time constraints. To monitor waterbird response to the impoundment management, weekly surveys were conducted from spring melt to freeze up. In 2007, the Refuges participating in the Impoundment Study decided not to collect benthic and water column invertebrate samples because no treatment-related difference were observed from the previous two years of data.

#### Invasive Species Control

Carp was introduced to Bill Forward and North Pool in 2006 with an extreme high tide associated with a Nor'easter. In 2007, we attempted to remove carp from the Bill Forward Pool after it was drawn down for shorebird migration. We removed approximately 50 dead carp from the impoundment; however, efforts to seine and remove additional carp were not successful.

We also continued to remove mute swans attempting to nest in the impoundments. In 2007, our Law Enforcement officers removed 6 mute swans.

#### *Habitat Response*

##### Vegetation Surveys in Entire Impoundment

Vegetation surveys of the entire impoundments found higher species richness<sup>2</sup> in the Stage Island Moist Soil unit in 2007 compared to previous years. Species richness for the Stage Island Robust Vegetation and Bill Forward remained constant in the past three years. Appendix A includes the complete list of plants found in the impoundments from 2004-2006.

In the Bill Forward Pool, the vegetation in 2007 is very similar to that found in 2005. The most abundant species include *Agrostis stolonifera* (31%), *Lythrum salicaria* (19%), and *Phragmites australis* (12%). The increase in freshwater plant species we observed in 2006 was not evident in 2007, suggesting that it was a result of the heavy rains we received in May and June of 2006. Robust monotypic plants (*Phragmites australis*, *Lythrum salicaria*, and *Typha latifolia*) have declined since 2004 but did not change between 2005-2007.

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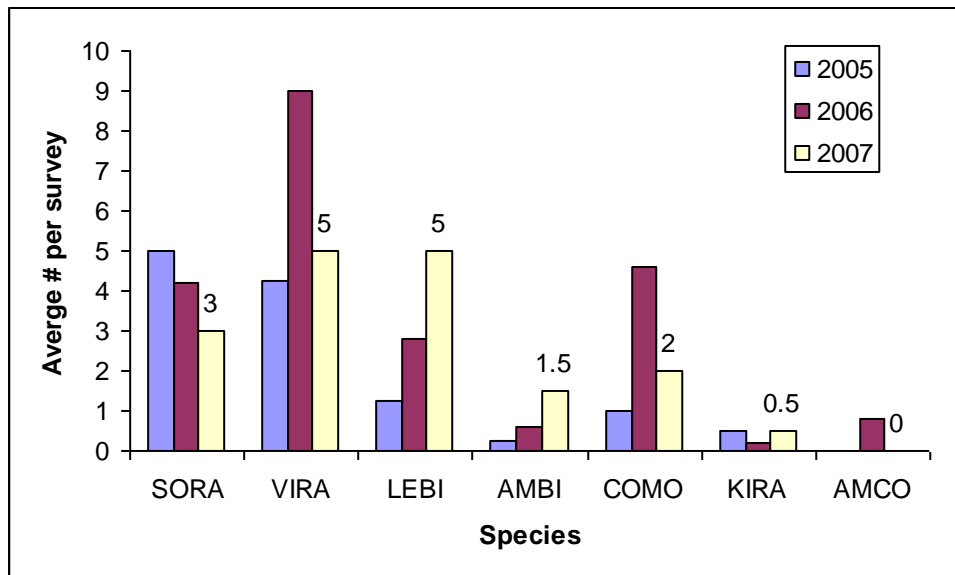
<sup>2</sup> Species Richness shown are Heltshe's Jackknif Estimates based on observed species richness and sample size.

In Stage Island Pool, *Eleocharis parvula* increased dramatically in both the moist soil and robust vegetation areas, indicating that the fall shorebird drawdown is resulting in more open, sparse vegetation in the impoundment. The most abundant plants in the Stage Island Robust Area include *Eleocharis parvula* (27%), *Phragmites australis* (23%), and *Bidens connata* (6%). The most abundant species in the Stage Island Moist Soil area include *Eleocharis parvula* (31%) and *Typha latifolia* (14%).

### *Response of Resources of Concern*

#### Monitoring and Surveys

A total of six marsh and wading species were detected during the call-back surveys in the North Pool in 2007. The most abundant and consistent species during the last three years were sora rail, Virginia rail, and least bittern (Figure 6). American bittern, common moorhen, king rail, and American coot also breed in the impoundment, but the number are low and variable from year to year.



**Figure 7.** Breeding marsh and wading birds detected in the North Pool since 2005. 2007 average birds per survey is displayed in graph.

#### Regional Shorebird Impoundment Study

Peak waterbird use in both impoundments occurred during the fall shorebird migration (see Appendix B). Maximum bird use in Stage Island Pool, with 3,186 birds, was recorded on August 2. Maximum bird use in Bill Forward Pool, with 1,291 birds, was recorded on August 16. These dates were similar to that of last two years, with higher number of bird use in each impoundment, particularly in Stage Island Pool.

Shorebirds were by far the most numerous guild using the impoundments. Peak shorebird used was recorded in the Bill Forward Pool on August 16 (1,291), and in Stage Island Pool on August 2 (2,775), both dominated by SEPL, SAND, SESA and SBDO. Waterfowl was the second most numerous guild using the impoundments. Peak waterfowl use was recorded on November 8 in Bill Forward Pool (579 dominated by

NOPI and ABDU) and in the Stage Island Pool (1044 dominated by NOPI, ABDU, MALL) (Figure 13). Wading bird use peaked on August 2 in Stage Island (76), but did not have peak abundance in the Bill Forward Pool.

*Proposal Year: Management Strategy Prescriptions*

- Complete the Regional Impoundment Study by implementing spring waterfowl drawdown in Bill Forward in March. Continue to monitor waterbirds in both impoundments through the waterfowl migration.

**BFP:** *Spring Waterfowl, Fall Shorebird Migration Drawdown*

- Maintain full pool during winter months (until March)
- Starting early March, drawdown water levels during a 2-3 week period to provide spring waterfowl migration habitat. Maintain water levels (2.7') at an average depth of 12-18 inches for 2-3 weeks, then flood up to full pool (4.0') by early May.
- Maintain full pool from May until late June.
- Starting late June to early July, drawdown water levels (2.3') over a 6-8 week period such that shallow water (<10 inches) and mudflats are maximized at peak fall shorebird migration (late July).
- Maintain low water levels (1.8') from mid August to early September to encourage germination of moist-soil plants.
- Starting early September, start slow flooding of impoundment to maximize optimal water level (2.5') for dabbling ducks (12-18 inches) in later September and diving ducks (>24 inches, 3.5') in late October.
- Flood water level to full pool (4.0') prior to freeze date.

**SIP:** *Fall Shorebird, Spring and Fall Waterfowl Migration Drawdown*

- Maintain full pool during winter and spring months (until April).
  - Starting mid April, drawdown water level (1.5'-2.0') during a 6-8 week period such that shallow water (<10 inches) and mudflats are maximized at peak shorebird migration (late May).
  - Maintain low water (1.0') from mid June to mid August to encourage germination of moist-soil plants and growth of invertebrate population.
  - Starting mid-August, start slow flooding of impoundment for the late shorebird fall migration and fall waterfowl migration. Maximize optimal water level (2.5') for dabbling ducks (12-18 inches) in mid September and optimal water level (3.0'-3.5') for diving ducks (> 24 inches) in mid October.
  - Flood water level to full pool (5.0') prior to freeze date.
- Install staff gauges in relation to mean sea level at the North Pool water control structure.
  - Continue to manage the North Pool to benefit breeding wading birds and waterfowl by maintaining high water levels through the breeding season (April –

- August). Continue marsh and wading bird breeding survey (4 surveys) in the North Pool.
- Monitor plant response to water level management using established vegetation plots in Bill Forward and Stage Island Pool according to 1994 monitoring protocols.
  - Manage the robust vegetation area against invasive plants (i.e. Phragmites, purple loosestrife) and promote a mix of native wetland plants (e.g. cattail, asters, beggars tick).
    - Using water level manipulation, and if necessary aerial herbicide and mowing, manage against Phragmites and cattail in Stage Island and Bill Forward Pools. Treat Phragmites in the North Pool through aerial herbicide.

## **G. Thacher Island**

### *Habitat Objective*

By 2015, restore a colony of common and roseate terns to Thacher Island NWR by creating gull-free zones on the Refuge portion of the Island, removing predators, and providing optimal breeding habitat in an area not susceptible to storm surges.

### *2007 Management Prescriptions*

Seven Refuge staff and volunteers conducted the annual gull nest census on June 6<sup>th</sup>. We counted 257 black-backed gull (GBBG) nests and 1,050 herring gull (HERG) nests and punctured 650 GBBG eggs and 2,795 HERG eggs. We also counted 38 GBBG and 46 HERG chicks that had already hatched. On June 29<sup>th</sup>, we conducted a second nest count, and recorded 33 GBBG and 768 HERG renests. We punctured an additional 40 GBBG and 1,507 HERG eggs. 16 GBBG chicks and 61 HERG chicks had hatched between the two census windows.

### *Habitat Response*

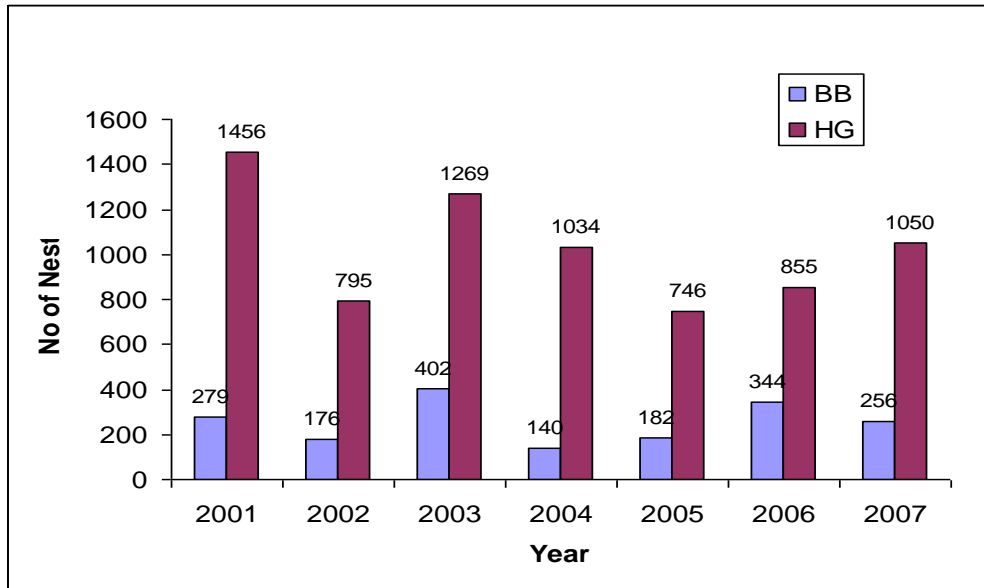
N/A

### *Response of Resources of Concern*

The gull population at Thacher Island appears to have declined since we started the population control program in 2002. Specifically, herring gull population has declined while black-backed gull populations have increased.

### *Proposal Year: Management Strategy Prescriptions*

- Conduct breeding gull census in late May and addle all eggs found. Conduct follow-up survey in mid June to monitor success of addling efforts.



**Figure 8.** Breeding gull census at Thacher Island. BB= black-backed gull; HG= herring gull. No eggs puncturing were conducted in 2001 or 2006.



### Appendix A Summary of Vegetation Survey in the Impoundments

Table A-1. Frequency of occurrence and percent abundance of plant species found in the robust vegetation area of the Stage Island Pool from 2004 to 2007

Species	2007	2006	2005	2004
Agrostis stolonifera			4.74	1.00
Atriplex patula			0.32	0.02
Bare Ground		33.67	15.80	21.45
Bidens connata	6.16	0.02	1.27	1.52
Calystegia sepium	0.11	0.13	0.32	0.20
Chenopodium rubra	1.01	0.80	0.03	
Cyperus esculentus			0.14	
Cyperus filicinus	0.07		0.46	
Eleocharis parvula	27.22	0.02	0.27	0.02
Erechtites hieracifolia	1.53	0.62	3.67	0.12
Gallium species	0.11	0.34	0.70	0.62
Hypericum species	0.18		0.49	
Impatiens capensis			0.14	
Juncus canadensis	0.04	0.04	0.46	0.18
Lythrum salicaria	1.46	1.13	3.40	3.97
Panicum dichotoflorum	2.77	8.95	34.35	
Panicum sp.			6.20	0.02
Parthenocissus quinquefolia			0.03	
Phragmites australis	22.53	17.43	30.41	13.76
Polygonum sp.		0.06	0.92	0.02
Rumex sp.		0.13	1.65	0.36
Scirpus americanus		0.34		0.73
Scirpus maritimus		4.42	3.92	
Scirpus pungens	0.33		0.89	
Spartina pectinata	0.18		2.87	1.48
Toxidendron radicans		0.02		0.15
Typha latifolia	4.17	6.80	8.91	8.39
Water		21.06		8.55
Wrack		0.84		22.65
<b>Species Richness</b>	<b>25</b>	<b>19</b>	<b>27</b>	<b>23</b>

Table A-2. Frequency of occurrence and percent abundance of plant species found in the Stage Island Pool, Moist Soil area from 2004 to 2007.

<b>Species</b>	<b>2007</b>	<b>2005</b>	<b>2004</b>
Agrostis stolonifera	3.82	2.10	0.08
Atriplex patula	0.08		0.25
Bare Ground	18.29	35.73	16.33
Bidens connata	3.05	1.23	2.10
Carex sp.			2.10
Chenopodium rubrum	1.97	0.08	
Cyperus esculentus	0.15		
Cyperus filicinus		6.72	
Cyperus strigosus		0.08	
Eleocharis parvula	30.88	8.62	
Erechtites hieracifolia	5.44	1.15	0.62
Galium tinctorium	0.15		0.53
Juncus sp.	1.15		0.08
Lythrum salicaria	1.76	2.58	1.15
Panicum dichotoflorum	3.58	10.87	
Panicum sp.		2.33	
Panicum virgatum			
Scirpus maritimus	0.38	0.70	1.23
Scirpus pungens/americanus	4.52	1.77	
Spartina alterniflora			
Spartina pectinada		3.27	
Spergularia maritima		0.62	
Phragmites australis	7.62	1.52	16.25
P. australis (dead)		4.05	
Typha sp.	14.44	17.63	32.32
Water	16.83	9.80	3.27
<b>Species Richness</b>	<b>26</b>	<b>22</b>	<b>17</b>

Table A-3. Frequency of occurrence and percent abundance of plant species found in the Bill Forward Pool from 2004 to 2006

Species	2007	2006	2005	2004
Agrostis stolonifera	30.53	11.14	30.00	13.48
Aster subulatus	2.85	3.36		
Aster tenuifolius		7.07		0.62
Atriplex patula	1.42	0.48	0.17	0.17
Bare Ground	7.80	2.45	16.27	
Bidens Conata	2.60	19.83	1.80	4.10
Calystegia sepium		0.36	2.43	1.85
Carex straminea		0.12	1.23	
Chenopodium rubra	1.77	0.48		
Convulvus arvensis		0.12		
Cyperus filicinus	0.08	0.12		
Cyperus strigosus		1.45	0.53	
Dodder				0.17
Echinochloa sp.	0.42	0.24		
Eleocharis parvula	20.95	4.07	29.13	19.30
Epilobium cilatum		0.74		
Erechtites heiracifolia	0.50	0.6	1.60	1.73
Erogostis sp.		0.86		
Gallium tinctorium	0.17	11.79		0.62
Hordeum jubatum		0.12	1.80	
Juncus canadensis		0.12	0.08	
Juncus gerardii			0.62	
Lycopus americanus	0.08	0.36	0.08	
Lythrum Salicaria	19.08	19.86	5.63	34.35
Panicum dichotoflorum	3.78	11.8	1.88	
Panicum virgatum				2.18
Parthenocissus quinquefolia				0.53
Phragmites australis	12.25	7.5	11.05	16.63
Pluchea purpurens	2.77	5.9	0.17	1.12
Polygonum spp		0.73		0.33
Polygonum punctatum		1.48		
Rumex sp.	0.08	0.12	0.70	0.08
Rumex verticillatus		0.12		
Schoenoplectus maritimus		2.5	0.53	4.80
Schoenoplectus pungens	2.68		1.88	6.38
Schoenoplectus sp.	10.68	2.5	2.41	11.18
Scirpus acutus		0.98		
Scirpus validus				0.08
Solidago sempervirens			0.17	
Symphyotrichum subulatum				1.43
Toxicodendron radicans				2.87
Typha spp.	5.12	5.05	6.12	9.63
Water			13.60	24.13
<b>Species richness</b>	<b>24</b>	<b>35</b>	<b>22</b>	<b>28</b>

**Appendix B**  
**Waterbird Use in the Impoundments in 2007**